AMERICAN DOCTORAL DISSERTATIONS.

H. J. ETTLINGER, "Existence theorems for the general real self-adjoint linear system of the second order," *Transactions of the American Mathematical Society*, vol. 19, January, 1918, pages 79-86. (First part of dissertation, Harvard, 1919).

PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND OTTO DUNKEL.

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PROBLEMS FOR SOLUTION.

[N.B. The editorial work of this department would be greatly facilitated if, on sending in problems, the proposers would also enclose their solutions—*when they have them.* If a problem proposed is not original the proposer is requested *invariably* to state the fact and to give an exact reference to the source.]

2850. Proposed by SARAH BEALL, U. S. Coast and Geodetic Survey.

An unknown star is observed at the altitudes h_1 and h_2 at the respective times t_1 and t_2, the latitude being known also. Obtain formulas for the right ascension and declination of the star: (1) when the time interval $t_2 - t_1$ is large: (2) when the time interval is so small that $(h_2 - h_1)/(t_2 - t_1)$ may be taken as the value of dh/dt corresponding to the mean altitude $(h_1 + h_2)/2$ and the mean time $(t_1 + t_2)/2$. This problem sometimes arises when a bright star is observed through the clouds.

2851. Proposed by HILLEL PORITSKY, Cornell University.

Does there exist an analytic function, satisfying the functional equation, $f(z + 1) = e^{f(z)}$?

2852. Proposed by D. H. RICHERT, Bethel College, Newton, Kan.

What is the radius of a cylinder inscribed in a right cone, radius of base $R = 5$ inches, and altitude $h = 18$ inches, the volume of the cylinder to be $(1/n = 3/4)$ that of the cone?

2853. Proposed by J. S. BROWN, Southwest Texas State Normal College, San Marcos, Texas.

Find the side and apothem of a regular pentagon inscribed in a circle, without the use of extreme and mean ratio.

2854. Proposed by C. N. MILLS, Heidelberg University.

Solve the simultaneous equations for x and y,

$$x^n + y^n = a_n, \qquad x^{n-1} + y^{n-1} = a_{n-1}.$$

2855. Proposed by J. L. RILEY, Stephenville, Texas.

Show that the circle of curvature at any point of the ellipse cannot pass through the centre unless the eccentricity be greater than $1/\sqrt{2}$.

2856. Proposed by O. S. ADAMS, U. S. Coast and Geodetic Survey.

Show that for the real domain defined by $+1 > x > -1$, s a positive integer,

$$\frac{1}{(1-x^s)^{1/s}}\int_0^x \frac{dx}{(1-x^s)^{(s-1)/s}} = x + \sum_{n=1}^{n=\infty} \frac{2(s+2)(2s+2)\cdots(ns-s+2)}{(s+1)(2s+1)\cdots(ns+1)}\, x^{ns+1}$$

and

$$\frac{1}{(1-x^s)^{(s-1)/s}}\int_0^x \frac{dx}{(1-x^s)^{1/s}} = x + \sum_{n=1}^{n=\infty} \frac{n!\, s^n}{(s+1)(2s+1)\cdots(ns+1)}\, x^{ns+1}.$$

2857. Proposed by the late L. G. WELD.

A savings bank offers to pay 3% interest on deposits, said interest to be continuously compounded, *i.e.*, compounded at infinitesimal intervals of time. What would be the amount of $1.00 for one year?